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FORAGE PLANTS IN A MONTANA HIGH ALTITUDE NURSERY

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High mountain watersheds are the storehouses for water which is the core of existence in the valleys below. They may also furnish forage to domestic and wild grazing animals. How well they meet these needs depends directly on the type and quality of plant cover. On those watersheds primarily adapted and used for grazing, maintenance or development of a desirable herbaceous cover is especially essential. Where management of grazing alone will not bring about the desired results, reseeding to forage species may be a worthwhile alternative. To use this alternative effectively the land manager must first know which species or varieties will live and thrive in the restrictive high mountain environment.

This paper compares stand changes, vigor, and some growth characteristics of forty species and varieties in a high altitude nursery in southwestern Montana. Trends of stands over a period of ten years are used for dividing the species tested into groups of varying adaptation.

The Study Area and Methods

This high altitude nursery is located on Lazyman Hill of the Gravelly Range Mountains in the Beaverhead National Forest. Its exposure is to the south-southwest on an 11 percent slope. Elevation is 9,350 feet above mean sea level.

The area is typical of fertile, high mountain grasslands in southwestern Montana. Idaho fescue (Festuca idahoensis) is the dominant species in the general area, but bearded and slender wheatgrasses (Agropyron subsecundum and A. trachycaulum), mountain brome (Bromus carinatus), bluegrasses (Poa spp.), and the forbs -- Grandads whiskers (Sieversia ciliata), and Cinquefoil (Potentilla spp.) are important constituents of the community. Big sagebrush (Artemisia tridentata) occurs commonly a thousand feet lower in the general region and on some of the south slopes to nearly the same level.

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Alpine fir (Abies lasiocarpa), white bark pine (Pinus albicaulis), and Engelmann spruce (Picea engelmanni) are the primary tree species found in nearby timber types at this elevation. High productiveness of the nursery site is indicated by the lush growth of the surrounding native vegetation, which provides a cover of 50 percent or more.

Annual precipitation at the nursery is estimated to be at least 20 inches. This is evenly distributed throughout the year, except for a slight peak in June. Average monthly temperatures are likely to be above freezing only between May and September, inclusive. Frosts may occur in any month of the year.

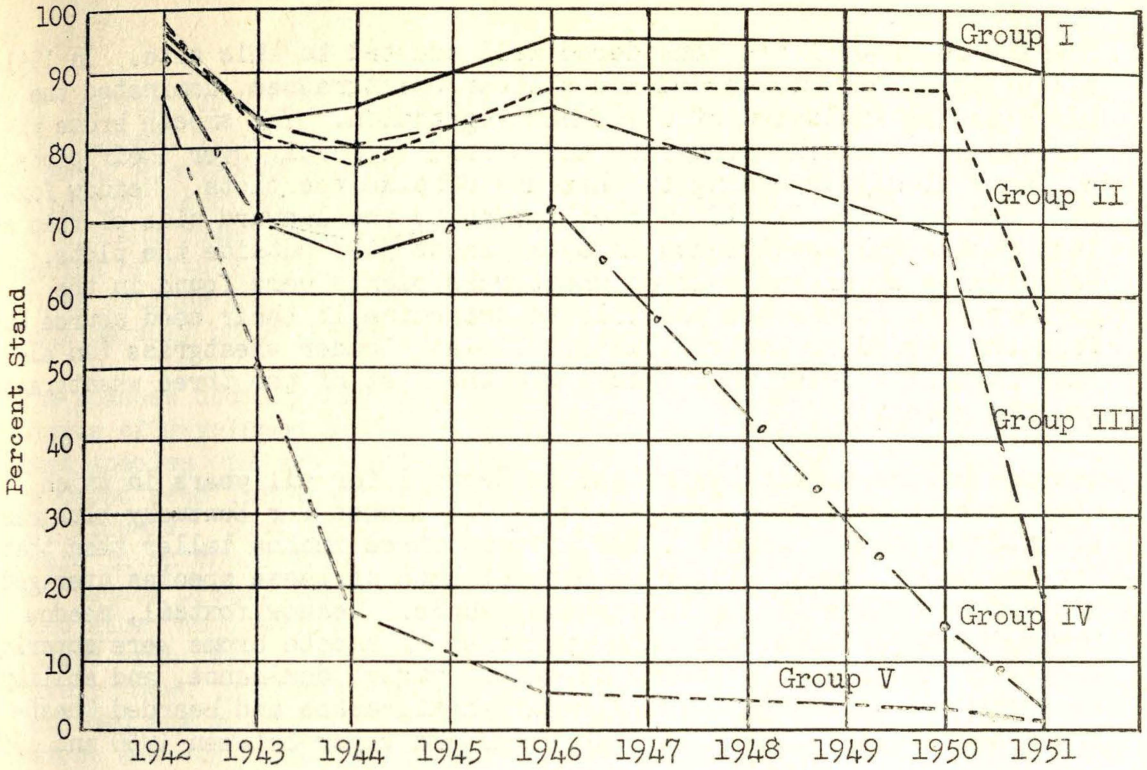
The sod on the nursery site was broken with a walking plow in 1940. In 1941 it was disked and floated. On July 7, 1942, forty forage species were seeded in rod-long rows spaced two feet apart. As far as is known, seed used was, with one exception, from sources having much lower elevations.

Observations of the seedling stands were made in the fall of 1942. Thereafter, data were collected in late summer or early fall each year from 1942 through 1946 and again in 1950 and 1951. Of the data taken on these plots, those on stand, and to a lesser extent, vigor, were basic in the evaluation of species. Stand was estimated ocularly as the percent of row fully occupied by reseeded plants. Relative vigor estimates were based on apparent robustness and over-all size of plants. These estimates were recorded on a scale ranging from one to five, with one representing very poor vigor and five excellent. Observations were also made on stage of development, height growth, reproduction, and certain other characters.

Results

All species produced fair to excellent seedling stands, but only eight maintained their stands and were vigorous over the entire period, from 1942 through 1951. Others died within three years, while still others responded well for a varying number of years. This variation in time at which stands were affected forms the foundation for the classification used herein.

Those maintaining their stands satisfactorily throughout the period were put in one classification; those failing to do so were grouped according to when the major stand decreases took place and by the intensity of change. When stand changes were plotted five groups could be identified in which the species in each showed similar average responses. These are shown in Figure 1.



Legend:

Group I: Common and Parkland strains of smooth brome (Bromus inermis), meadow foxtail (Alopecurus pratensis), meadow brome (Bromus erectus), Kentucky bluegrass (Poa pratensis), violet, slender, and bearded wheatgrasses (Agropyron trachycaulum var. violaceum, A. trachycaulum, and A. subsecundum).

Group II: Hard fescue (Festuca ovina duriuscula), thickspike and Fairway crested wheatgrasses (Agropyron dasystachyum and A. cristatum), red fescue (Festuca rubra), Russian wildrye (Elymus junceus), and native mountain brome (Bromus carinatus).

Group III: Intermediate and bluestem wheatgrasses (Agropyron intermedium and A. smithii), a perennial barley (Hordeum brevisubulatum), and Virginia, Dahurian, and Siberian wildrye grasses (Elymus virginicus, E. dahuricus, and E. sibiricus).

Group IV: Timothy (Phleum pratensis), standard crested wheatgrass (Agropyron cristatum), birdsfoot deervetch (Lotus corniculatus), and meadow fescue (Festuca elatior).

Group V: Rough and Idaho fescues (Festuca scabrella, F. idahoensis), redtop (Agrostis alba), bluebunch, Siberian, and beardless wheatgrasses (Agropyron spicatum, A. sibiricum, and A. inerme), tall oatgrass (Arrhenatherum elatius), Canada and big bluegrasses (Poa compressa and P. ampla), a non-native strain of mountain bromegrass (Bromus carinatus), orchard grass (Dactylis glomerata), yellow sweetclover (Melilotus alba), red, strawberry, and white clovers (Trifolium pratense, T. fragiferum, T. repens).

Figure 1. Characteristic stand changes of five groups of forage species in a high altitude nursery in southwestern Montana.

Species in Group I are considered well adapted to this site. In 1951 all of them, except bearded and slender wheatgrasses, dominated the plots to the exclusion of all other vegetation. The smooth brome varieties and Kentucky bluegrass had spread uniformly over their plots and were slowly spreading by rhizomes outside the plots. Meadow foxtail had reseeded itself in open spaces to the leeward side of rows of less successful species and in open places just outside the plots. Volunteer slender and bearded wheatgrass plants were found in the nursery, but it was not possible to determine if their seed source was from the seeded or native plants. Violet slender wheatgrass (an alpine form of slender wheatgrass) was the best of the three wheatgrasses in this group.

Average mature vegetative height in Group I for all years in which measurements were made, ranged from 10.5 inches for Kentucky bluegrass to 16.8 for common smooth brome, two to three inches taller than that for any other group. Vigor ratings of each of these species averaged above four on the one to five rating scale. Meadow foxtail, meadow brome, Kentucky bluegrass, and varieties of smooth brome were superior to the other species in terms of stand, vigor, dominance, and ability to spread on this site. The slender wheatgrasses and bearded wheatgrass decreased slightly in both stand and vigor between 1950 and 1951.

Species in Group II showed fair adaptation. All of them, except hard fescue, had by 1951 been invaded to some extent by various species native to the area -- indicating their lack of dominance. Thickspike wheatgrass and red fescue had formed a sod in local spots, but otherwise had spread very little, if at all. No seedlings or volunteer plants of these species were observed. Hard fescue and Fairway crested wheatgrass maintained good stands and robust growth for nine years before winterkill reduced their stand by about 50 percent. Mountain brome from native seed also maintained its stand until the last year, when it dropped from 90 to 25 percent. Although generally short-lived, rapid development of this species makes it useful in certain situations. Russian wildrye maintained its stand but lacked robustness.

Average vegetative heights ranged from 8.8 inches for Russian wildrye to 12.8 for hard fescue, while average vigor ratings varied from 3.1 for Russian wildrye to 4.3 for hard fescue and red fescue.

Species in Group III failed to maintain dominance of the plots and all were more or less invaded by native grasses and forbs. Remnants of each species, however, were still present in 1951.

Vigor ratings averaged between 2.9 for bluestem wheatgrass and 3.5 for Dahurian wildrye. Average vegetative heights ranged from 6.3 inches for bluestem wheatgrass to 12.2 for Siberian wildrye. The wildrye species were superior to bluestem and intermediate wheatgrasses.

Groups IV and V were comprised of species or strains that were either completely killed or severely reduced in stand at an early date.

Of the species in Group IV, timothy maintained the best stands and had the highest vigor over the entire period. All tall fescue and standard crested wheatgrass plants were dead by 1951. A few tiny plants of birdsfoot deervetch were found the last year. In Group V only Idaho fescue and rough fescue maintained any surviving plants throughout the period of study. None of the clovers was found after the third year. Vigor ratings for most of these species were low, and heights averaged considerably below those of other groups.

The grasses usually remained green and predominantly in the vegetative stages of development throughout the summer. Heads were few and for most species did not emerge until August. Even when heads were produced seed formation was rare because heavy frost usually killed the flowers. Species which produced heads four or more of the six years in which observations were made were: meadow foxtail, mountain and meadow brome, Idaho, hard, red, and rough fescues, Hordeum brevisubulatum (no common name), and Kentucky bluegrass. Meadow foxtail headed each year. Only meadow foxtail and mountain brome are positively known to have produced viable seed. No heads were produced on intermediate wheatgrass. Fairway crested wheatgrass headed only twice, and standard crested wheatgrass three times in six years. None of the legumes bloomed. Survival did not appear to be associated with flower stalk production in any species.

Conclusions

Only eight of the forty species planted in a high altitude nursery in southwestern Montana maintained vigorous stands over a ten-year period. They were: common and Parkland smooth bromes, meadow foxtail, Kentucky bluegrass, meadow brome, and violet, slender, and bearded wheatgrasses. Of these, the bromes, meadow foxtail, and Kentucky bluegrass not only persisted but were superior in capacity to spread and dominate the site. They are therefore recommended as preferred for reseeding comparable high altitude sites in Montana.